Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
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Petition for Rulemaking of The Elefante Group, Inc. to Enable Fixed Stratospheric-Based Communications Services in the 21.5-23.6, 25.25-27.5, 71-76, and 81-86 GHz Bands	)	RM-11809

REPLY COMMENTS OF FACEBOOK, INC.

August 15, 2018

Christopher Weasler

Facebook, Inc.

1 Hacker Way

Menlo Park, CA 94025

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I. Introduction and Summary

Facebook, Inc. ("Facebook") supports Elefante Group's ("Elefante") petition to initiate a rulemaking to modify Parts 2, 101 and other rule Parts as may be necessary to enable the deployment of stratospheric communications services in the United States.[1]

Facebook's mission is to give people the power to build community and bring the world closer together. And connecting people is a critical first step in executing this mission. Today, nearly four billion people worldwide are still not connected to Internet.[2] Among those that have connectivity, many are under-connected. Connecting these people is a complicated effort that requires not just bringing network infrastructure to more people, but involves addressing the regulatory environment.

To do its part, Facebook, working with a range of partners, has launched several initiatives focused on connecting the unconnected and under-connected. It will take a mix of technical solutions to bring connectivity to all. As such, Facebook has supported research and development efforts in a range of technologies, including terrestrial, mobile, satellite, and high altitude platform stations ("HAPS"). Facebook has invested in HAPS R&D to prime the ecosystem for this promising tool for broadband connectivity. HAPS is an initiative that could provide more affordable, fast and flexible backhaul to broadband services, and could further

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[1] *Petition to Modify Parts 2 and 101 of the Commission's Rules to Enable Timely Deployment of Fixed Stratospheric-Based Communications services in the 21.5-23.6, 25.25-27.5, 71-76, and 81-86 GHz Bands*, Petition for Rulemaking of Elefante Grp., Inc., RM Docket No.11809 (rel. Jun. 1, 2018) ("Elefante Petition").

[2] *The Inclusive Internet Index: Bridging digital divides* at 8, https://theinclusiveinternet.eiu.com/assets/external/downloads/3i-bridging-digital-divides.pdf (citing International Telecommunication Union, Key ICT indicators for developed and developing countries and the world, 2005-2016).

become a key link to emergency communications in the wake of natural disasters. Facebook's focus is on a HAPS segment of stratospheric communications operating at altitudes above 20 km. To accelerate commercial viability of HAPS, Facebook has initiated development of a broadband communications system supporting a range of partners.

For these reasons, Facebook supports Elefante's petition to initiate a proceeding to modify the Commission's rules to enable the deployment of stratospheric services including HAPS. Facebook requests that the rulemaking examine whether to modify applicable rules to enable stratospheric platforms in the 21.4-22 GHz band, 24.25-27.5 GHz band, as well as the 38-39.5 GHz band that has been studied internationally for HAPS identification.[3] Section 7 of the Communications Act,[4] among other sections, supports such an effort. Furthermore, a separate HAPS proceeding would allow the Commission and interested stakeholders to examine fully the issues related to this technology. Finally, Facebook agrees with Elefante that to promote investment in this technology, stratospheric platforms should have co-primary access under Commission rules to the bands ultimately identified by the Commission for HAPS.

II. Facebook's Approach to HAPS

Facebook has invested substantial time and resources in HAPS as a method for improving connectivity at lower cost points. Facebook began its HAPS R&D by acquiring an aviation company in 2014 that was developing a fixed-wing solar plane. Facebook successfully

[3] For these comments, Facebook will use the terms "high altitude" and "stratospheric" largely as synonyms, and may refer to Elefante Group's stratospheric platform stations and services as high-altitude or HAPS-like. At the International Telecommunication Union, HAPS refers to the *platform* in the stratosphere, and is considered an *application* of a service, and not a service itself.

[4] *See* 47 U.S.C. § 157(a).

flew its solar aircraft Aquila multiple times over the past couple of years, which demonstrated the feasibility of HAPS aircraft and accelerated the development of HAPS partners.

Growing interest in stratospheric aviation inspired the Aerospace Industries Association to form the Upper Airspace Working Group ("UAWG")[5], in order to participate in the International Civil Aviation Organization's (ICAO) activities relative to HAPS and other high-altitude applications. Today, the UAWG includes Facebook, Google, Harris, Lockheed Martin, Northrup Grumman, Rockwell Collins, AeroVironment, General Atomics and Alta Devices. Recent press accounts note additional innovators exploring HAPS for communications connectivity.[6] At ICAO, the UAWG is working with the global aerospace community on the development of international regulations to ensure safe and efficient operations of UAS at high-altitude.[7]

Facebook expects that its communication system can achieve multi-gigabit broadband speeds from the HAPS at 20 km, over spectrum bands that were identified by the International Telecommunication Union ("ITU") for study at the 2015 World Radiocommunication Conference ("WRC"), for possible identification for HAPS at WRC-19.

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[5] *Upper Airspace Working Group Paves Way for New and Emerging Aerospace Technologies*, Aerospace Industries Association (Jul. 5, 2017), https://www.aia-aerospace.org/upper-airspace-working-group-paves-way-for-new-and-emerging-aerospace-technologies/.

[6] KT Corp., *KT Unveils 5G Emergency Rescue Platform 'SKYSHIP'*, Cision (Jul. 5, 2018, 4:52 PM), https://www.prnewswire.com/news-releases/kt-unveils-5g-emergency-rescue-platform-skyship-300676490.html ("KT News Release"); *see also* Sam Davis, *Prototype Solar-Powered, High-Altitude UAV Undergoing Flight Tests*, Machine Design, (Jul. 24, 2018), https://www.machinedesign.com/motion-control/prototype-solar-powered-high-altitude-uav-undergoing-flight-tests.

[7] *Alta Devices Joins Elite high Altitude Leadership Group*, Alta Devices (Jul. 14, 2017), https://www.altadevices.com/alta-devices-joins-elite-high-altitude-leadership-group/ ("Alta Joins Leadership Group").

III. WRC-19 Agenda Item 1.14

At the most recent WRC, in 2015, after the U.S. announced that achieving a HAPS study was one of its priorities for the Conference, and with the strong support of Region 2 and a number of developing countries worldwide, WRC-15 adopted an agenda item to explore whether additional bands needed to be identified to enable HAPS to deliver broadband applications.[8] The Conference invited ITU member countries to study 21.4–22 GHz, 24.25-27.5 GHz and 38-39.5 GHz for possible HAPS identifications. At the most recent meeting of Region 2 to prepare for WRC-19, the Inter-American Telecom Commission (CITEL) agreed on a Draft Inter-American Proposal ("DIAP") to identify HAPS at 24.25-27.5 GHz and 38-39.5 GHz.[9] In addition to this DIAP to identify 24.25-27.5 GHz and 38-39.5 GHz for HAPS, Mexico proposed that 21.4-22 GHz be identified for HAPS.[10] Facebook supports Elefante's Petition to initiate a rulemaking to propose modifying Parts 2 and 101 and other rule parts as necessary, but requests that the rulemaking examine whether to modify applicable rules to enable stratospheric platforms in the full 24.25-27.5 GHz band, and not the more narrow 25.25-27.5 GHz band Elefante requests, as well as in the 38-39.5 GHz band that has been studied internationally for HAPS identification.

WRC-15 also adopted an agenda item to study bands between 24 – 86 GHz for International Mobile Telephony (IMT) 2020, largely synonymous with "5G." Facebook has supported identification of IMT 2020 and HAPS in the same ITU study bands, subject to

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[8] *Facilitating access to broadband applications delivered by high-altitude platform stations*, 2015 World Radiocommunication Conference, Resolution 160, ("Resolution 160").
[9] Inter-American Telecommunication Commission ("CITEL"), *Draft InterAmerican Proposals For WRC-19 Agenda Item 1.14*, at 3-10, CCP.II-RADIO-31/doc.4358-1-14/18 (Jul. 19, 2018) ("DIAP").
[10] Inter-American Telecommunication Commission, *Preliminary Proposal by Mexico For WRC-19 Agenda Item 1.14*, at 3, CCP.II-RADIO-31/doc.4357-1-14/18 (Jul. 18, 2018) ("Mexico's Preliminary Proposal").

effective power flux density ("pfd") protection criteria for IMT 2020, in order to ensure economies of scale for the broadband components for HAPS (antennas, chips, etc.), so that HAPS backhaul will be affordable.[11] If HAPS is only identified in "orphan bands" that will not benefit from a global ecosystem of broadband equipment, HAPS will not be a viable, affordable solution for unserved or underserved markets in the U.S. or around the world.

Facebook's (and others' at the ITU)[12] studies show that with appropriate pfd limits, HAPS can co-exist with IMT 2020 as well as with Fixed Satellite Systems and Fixed incumbents in the 24.25-27.5 GHz range to enable flexible use of the band. Facebook's (and others' at the ITU) studies also show that HAPS can co-exist with Radio Astronomy, Earth Exploration and Science Research services, with appropriate out-of-band emission limits. Facebook has invested considerable resources in spectrum sharing techniques and has actively participated in the Dynamic Spectrum Alliance and other fora. Facebook has confidence that HAPS and IMT 2020 and other flexible uses can co-exist in the 24.25-27.5 GHz band and 38-39.5 GHz bands.

IV. The Communications Act Requires the Commission Initiate a Rulemaking

Facebook agrees with Elefante that the Communications Act requires that the Commission respond to Elefante's petition to initiate a rulemaking proceeding.[13] Section 7 of

[11] Brazil, an advocate for identifying the 24.25-27.5 GHz band for HAPS at CITEL likewise advocated identifying the 24.25-27.5 GHz band for IMT 2020 as well. Brazil maintains that its studies show that HAPS and IMT 2020 can co-exist in the band with effective protection criteria.
[12] *See* Preliminary draft new Report ITU-R F.[HAPS-26GHZ] - *Sharing and compatibility studies of HAPS systems in the 24.25-27.5 GHz frequency range* (France, Germany, and Slovenia Study, Document 5C/507, Study B; Brazil Study, Document 5C/483, Study C) (Annex 17 of the ITU-R Working Party 5C Chairman's Report, 5C/531) (June 7, 2018).
[13] Elefante Petition at 112.

the Act as well as the Commission's broader statutory mandates in Sections 151, 303 and 309 compel the Commission to move forward with a HAPS rulemaking proceeding.[14]

Section 7 of the Communications Act requires the Commission to initiate a rulemaking and adopt a Notice of Proposed Rulemaking within the year, because stratospheric platforms including HAPS are a "new technolog[y]"[15] leveraging recent and on-going advances in avionics, modular solar cells, composite lightweight materials, and lithium-battery technology.[16] The Commission's Technological Advisory Council, whose role is to help the Commission identify important areas of innovation and develop informed technology policies supporting America's competitiveness and job creation in the global economy, advised the Commission over a year ago to initiate a rulemaking on rules for high-altitude communications platforms.[17]

Furthermore, the Commission's statutory mandates under Section 151 of the Communications Act support the initiation of a rulemaking proceeding on HAPS. First, the Commission's core mission, as repeatedly noted by its leadership, is to make available affordable communications to all the people of the United States.[18] In Section 151 of the Communications Act, Congress established the Commission to make available "a rapid, efficient, Nation-wide, and worldwide wire and radio communication service with adequate facilities at reasonable charges."[19] Facebook notes Elefante's estimate that a high-altitude system may represent an 80% cost reduction over ground-based infrastructure[20] and believes such a cost reduction merits exploration by the Commission, particularly in light of its statutory mandate. Any significant

[14] 47 U.S.C. §§ 151, 157, 303, and 309.
[15] 47 U.S.C. § 157; *see also* Elefante Petition at 112.
[16] Alta Joins Leadership Group, *supra*.
[17] Dec. 7, 2016 Technological Adcisory Council Rep. 22 at 8.
[18] 47 U.S.C. § 151.
[19] *Id*.
[20] *See, e.g.*, Elefante Petition at 1.

cost reduction would help the Commission make available affordable communications to all the people of the United States, particularly those in rural, remote areas, given HAPS service contour of approximately 100 km.[21] Given HAPS' flexibility, capacity, large footprint, and lower-than-satellite latency, Facebook agrees with Elefante that HAPS backhaul will enable and complement 4G, 5G and IoT-enabling services and technologies.[22] And Commission rules to identify HAPS bands harmonized with our neighbors and other Regions will facilitate making a nationwide and worldwide HAPS backhaul marketplace.

Second, Section 151 requires the Commission to make available "efficient" radio communication services.[23] Efficient radio communication services require the highest use of the band, including sharing the spectrum on a geographic basis as appropriate.[24] While millimeter wave spectrum will be deployed in dense urban markets for flexible use services, for 4G and 5G, its propagation characteristics make it less technically and economically viable for mobile operations in suburban and rural markets. By contrast, mid-band spectrum, particularly at 3.4 – 3.8 GHz, is the leading band today for 5G globally, as shown by actual decisions taken by regulators across the globe, including auctions.[25] Therefore, although millimeter wave spectrum

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[21] The CITEL DIAP notes that the cost of operating high-altitude solar platforms is projected to be significantly lower than other connectivity solutions in many areas, while mass production of the aircraft will significantly lower upfront capital expenditures for deployment.
[22] *See, e.g.*, Elefante Petition at 51-53, 106.
[23] 47 U.S.C. § 151.
[24] *See, generally, Use of Spectrum Bands Above 24 GHz For Mobile Radio* Services, 32 FCC Rcd. 10988 (Nov. 22, 2017) ("*Spectrum Frontiers*").
[25] *See* Ministry of Internal Affairs and Communications, 5G Initiatives in Japan (2017), https://5gmf.jp/wp/wp-content/uploads/2017/06/02-Opening-Session-1_Isao-Sugino.pdf; 5G Americas Reply at 32 n.24, T-Mobile Comments at 8 n.30 (citing Kuniko Ogawa, Director for Land Mobile Communications Division, MIC, Japan's Radio Policy to Realize 5G in 2020 (2016), http://www.gsma.com/spectrum/wp-content/uploads/2016/08/MIC_Spectrum-for-5G-MIC-Kuniko-OGAWA.pdf); *see also* Stephen Temple, History of the 5G Pioneer Bands (global harmonization efforts centering on 3.6 GHz band), available at

like the 26 GHz band[26] may be developing as a priority band for WRC-19 for purposes of IMT 2020, ITU and other studies show it can be shared between HAPS and IMT 2020 with appropriate emission limits.[27] Moreover, there is growing global interest in the 38-39.5 GHz band for HAPS.[28] Given the potential for efficient sharing of these millimeter wave spectrum bands with HAPS and the possibility of global scale in these bands, the Commission should initiate a rulemaking proceeding on HAPS and include the 38-39.5 GHz band.

And third, a preeminent reason that the Commission is compelled under Section 151 to make available affordable communications to all Americans is for public safety.[29] HAPS has the potential to become a critical link in emergency communications services in the wake of natural disasters. The Resolution adopted at WRC-15 to initiate the HAPS study notes its possible use for disaster recovery communications.[30] One national mobile operator has used HAPS for disaster response communications.[31] The CITEL Preliminary View on HAPS, to which the

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http://www.gsmhistory.com/short-history-of-the-5g-pioneer-bands/; see also https://www.zdnet.com/article/south-korea-completes-5g-spectrum-auction/ (June 19, 2018); see also https://www.cept.org/ecc/topics/spectrum-for-wireless-broadband-5g (CEPT priority band for 5G is 3.4-3.8 GHz).

[26] CEPT has proposed that the 24.25-27.5 GHz band be identified for IMT 2020 and CITEL has a DIAP proposaing the band for IMT 2020.

[27] *See supra at n. 19*.

[28] As noted above, CITEL's Draft Inter-American Proposal proposes identifying the 38-39.5 GHz band for HAPS at WRC-19. DIAP at 10. The African Telecommunications Union's (ATU) Working Group responsible for the HAPS Agenda Item 1.14 has recommended that ATU identify the band for HAPS, given their strong interest in affordable broadband delivery platforms. Europe is still studying the 38-39.5 GHz band, but its draft Common Proposal for WRC-19 Agenda Item 1.14 proposes worldwide identifications for HAPS in the 28/31 GHz band. *See* Draft European Common Proposal on WRC-19 Agenda Item 1.14, available at https://cept.org/ecc/groups/ecc/cpg/cpg-pt-a/client/meeting-documents/?flid=8214

[29] *See supra* at n. 18.

[30] *See* Resolution 160, *considering* e).

[31] KT News Release, *supra* ("The new aircraft is made of three main parts. There is an airship filled with helium gas; the Skyship Pod, which carries core hardware items including propellants,

United States is a party, notes that "Broadband HAPS for specific applications are designed to focus on multiple usage cases, including: response to natural disasters; fire detection, monitoring and firefighting; law enforcement with communication needs across local actors and regional headquarters; and resource exploration missions for communication between exploration teams and regional home bases."[32] Likewise, the ITU Broadband Commission for Sustainable Development notes HAPS' use for disaster recovery.[33]

Beyond Sections 7 and 151, Section 303(g) of the Communications Act provides that the Commission shall study new uses for radio, provide for experimental use of frequencies, and generally encourage the larger and more effective use of radio in the public interest.[34] Stratospheric platforms like HAPS have the potential to cover large areas with lower latency than non-geostationary satellites.

Additionally, Section 309 supports the Commission's undertaking of a rulemaking proceeding on HAPS. The FCC has already announced spectrum auctions in the 24 GHz band

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cameras, network modules and drones; and Skyscan, which detects smartphone signals and synchronizes them with mobile carriers' customer database to identify personal information pertaining to survivors, such as names and ages. Signal scanning by Skyscan, which uses an ultra-small LTE device, can check the presence of survivors within a 50-meter radius, thereby narrowing the search area for faster rescues. When survivors are detected, Skyship will deploy drones to pinpoint their exact locations. Robots will then be dispatched on the ground to deliver emergency relief items, relay information to rescuers and take first-aid measures until rescuers arrive"); Project Loon worked with T-Mobile to restore communications following the hurricanes last season; *see* Comments of Loon LLC at 1, RM Docket No. 11809 (rel. Jul. 12, 2018).

[32] Inter-American Telecommunication Commission, Preliminary Views on WRC-19 Agenda Item 1.14, at 3, available at CCP.II-RADIO-31/doc.4356-1-14/18 (Jul. 19, 2018)

[33] *See, e.g.*, Broadband Commission for Sustainable Development, Working Group on Technologies in Space and the Upper-Atmosphere: *Identifying the Potential of New Communications Technologies for Sustainable Development* at 30, available at http://www.broadbandcommission.org/Documents/publications/WG-Technologies-in-Space-Report2017.pdf

[34] 47 U.S.C. § 303(g).

for this year and in the 39 GHz band for next.[35] Facebook supports those auctions going forward. New HAPS rules would allow more flexibility to Upper Microwave Flexible Use Service ("UMFUS") providers that win those auctions and are subsequently awarded licenses. The Communications Act provides auction policy that favors initiating a rulemaking as petitioned by Elefante, given its promise for broadband backhaul in rural communities. Section 309(j)(4)(B) requires the FCC to ensure its auction rules "promote investment in and rapid development of new technologies and services." Section 309(j)(4)(C) requires the FCC to ensure its auction rules promote equitable distribution among geographic areas and economic opportunities for a wide variety of applicants, including rural telecom companies. Initiating a rulemaking for stratospheric platforms now, while auctions in at least two of the HAPS study bands are imminent, will better ensure that eventual spectrum winners and licensees will have the flexibility sought by the Commission in *Spectrum Frontiers*, as well as by Congress in the Communications Act.

V. The Commission Should Initiate an Independent Proceeding

Facebook agrees with Elefante that the Commission should initiate a new proceeding rather than examine possible rule changes to allow HAPS under *Spectrum Frontiers*.[36] The HAPS ecosystem needs a separate proceeding because several issues related to HAPS have not

[35] *Auctions of Upper Microwave Flexible Use Licenses for Next-Generation Wireless Services*, Public Notice, FCC No. 18-109, AU Docket No. 18-85, ¶ 6 (rel. Aug. 3, 2018); *see also Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Notice of Proposed Rulemaking, FCC No. 18-110, GN Docket No. 14-177, ¶ 15 (rel. Aug. 3, 2018) ("*Fourth FNPRM*").

[36] CTIA—The Wireless Association suggests that the proposed rule changes raised by Elefante be discussed within *Spectrum Frontiers*. *See Opposition of CTIA*, Petition to Modify Parts 2 and 101 of the Commission's Rules to Enable Timely Deployment of Fixed Stratospheric-Based Communications Services in the 21.5-23.6, 25.25-27.5, 71-76, and 81-86 Bands, RM Docket No. 11809, at 1 (filed Jul 11, 2018).

been raised under the existing broader *Spectrum Frontiers* proceeding. For instance, the 21.4-22 GHz band has not been proposed by the Commission for flexible use. The frequency range 21.5-22 GHz was included in the WRC-15 Resolution initiating the study by ITU-R for possible action at WRC-19.[37] Moreover, the 21.4-22 GHz band has been proposed by our neighbor Mexico at CITEL for HAPS.[38] While the Commission has asked in the Third Further Notice of Proposed Rulemaking in *Spectrum Frontiers* whether it should permit HAPS in the newly proposed ***25.25***-27.5 GHz band, it has not asked about the lower 1 GHz of the full range being studied at the ITU-R, and proposed in a DIAP at CITEL (***24.25***-25.25 GHz). Nor has the Commission asked in *Spectrum Frontiers* about allowing HAPS in portions of the 37-40 GHz UMFUS band identified by WRC-15 (38-39.5 GHz) and contained in the CITEL DIAP and ATU's preliminary proposal. Some countries have submitted studies to the ITU suggesting that sharing at 38-39.5 GHz between HAPS and mobile services like 5G may be feasible with the appropriate pfd mask.[39] Such a study should be undertaken by the Commission as well.

Initiating a new proceeding, independent from *Spectrum Frontiers*, is also justified by the current state of the 39 GHz band in the Commission rules. Channelization of the 38-39 GHz band adopted for Part 30 under Spectrum Frontiers differs from the ITU-R identified HAPS study spectrum. While the recently adopted Fourth FNPRM in *Spectrum Frontiers* addresses the 37-40 GHz band, overlapping with the 38-39.5 GHz under review internationally,[40] operators of

[37] Resolution 160.
[38] Mexico's Preliminary Proposal at 3.
[39] *See* Preliminary draft new Report ITU-R F.[HAPS-39GHZ] - *Sharing and compatibility studies of HAPS systems in the 38-39.5 GHz frequency range* (France and Slovenia Study, Document 5C/509, Study A at Sections 1.1.1.1 and 1.1.2.4; China Study, Document 5C/496, Study C) (Annex 19 of the ITU-R Working Party 5C Chairman's Report, 5C/531) (June 7, 2018).
[40] *Fourth Further Notice of Proposed Rulemaking*, Docket Number 14-177, at ¶¶ 16-30 (rel'd August 3, 2018).

HAPS—a fixed application as planned by Facebook and under study globally—would still need a waiver of certain technical rules to address co-existence with non-geostationary satellite operations in the 38-39.5 GHz band and other bands and services.

VI. Conclusion

Rules that allow stratospheric platforms including HAPS to be deployed can further the Commission's goals in winning the race to 5G, as well as fulfilling its statutory duties to make affordable communications available to all Americans, including for public safety and emergency communications and those in rural communities, through larger, more effective and efficient spectrum use. Facebook supports Elefante's petition to initiate a rulemaking since stratospheric platforms including HAPS can help extend broadband in unserved markets, without slowing 5G in the 26 GHz band or other bands already assigned for UMFUS, like the 38-39.5 GHz band. Facebook supports the Commission's efforts to identify millimeter wave spectrum for flexible use, as well as international efforts on WRC-19 Agenda Item 1.13. But Facebook believes the Commission can continue to lead the global discussion on spectrum sharing and embracing innovative technologies by initiating a rulemaking on high-altitude broadband systems. Through granting Elefante's Petition, and creating a forum to develop technical co-existence rules for high-altitude stations that optimize spectral efficiency, the Commission will enable a wider range of platforms to extend broadband to all Americans. Ultimately, Facebook agrees with Elefante that to promote investment in this technology, stratospheric platforms should have co-primary access under Commission rules to the bands ultimately identified by the Commission for high-altitude platform stations.

Respectfully submitted

BY: */s/ Christopher Weasler*

Christopher Weasler

Facebook, Inc.

1 Hacker Way

Menlo Park, CA 94025